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(54) Title: FOAMABLE ANTIMICROBIAL FORMULATION

(57) Abstract: An antimicrobial formulation which comprises an antimicrobial agent, a surfactant and an emollient. The formulation has a low viscosity and has excellent foaming properties when used in a foaming dispenser. The formulation is useful in providing antimicrobial effectiveness in surgical scrub applications.

FOAMABLE ANTIMICROBIAL FORMULATION

BACKGROUND

This invention relates to antimicrobial formulations. More particularly, the invention relates to formulations that may be utilized in dispensing devices that generate a foam. Such formulations are particularly useful in the health care profession such as in surgical practice as a pre-operative scrub.

Hand washing by healthcare professionals is an essential component of infection control activities. Healthcare professionals wash their hands regularly to control the spread of infection from patient to patient. Hand washing procedures are performed in several ways and include products such as ordinary antimicrobial bar soaps, skin disinfecting or pre-operative prepping agents or rubbing alcohol. Such procedures and products may contain antimicrobial agents such as iodine, chlorhexidine gluconate, para-chlorometa-xylenol and hexachlorophenes.

Historically, the healthcare industry has used scrub brushes impregnated with antimicrobial agents for surgical skin preparation and pre and post patient care. These impregnated scrub brushes have proven to be an effective method of reducing the spread of infection in the healthcare setting and use a solution specifically designed for use in the scrub brush where the mechanical action of scrubbing with the foam brush creates a foam or lather.

In a continued effort to reduce the amount of cross contamination and to make these antimicrobial agents more accessible to a larger number of healthcare professionals and patients, the healthcare industry has more recently turned to bulk antimicrobial solution dispensing systems. These bulk systems have generally used solutions designed to be dispensed as liquid soap. Some solution dispensing systems provide a means for foaming the antimicrobial solution so that the solution is dispensed in a foamed state. An example of a foam solution dispensing system is described in copending United States patent application serial number 09/512,402, entitled, "Foam Forming Liquid Dispensing Device."

The foam generating device and system disclosed in United States application serial number 09/512,402 dispenses a homogeneous foam solution when the proper mixing of foamable solution and air occurs. The system includes a pressure generating source, such as a foot pump, which creates an increased pressure inside the closed container. This positive pressure difference across the container wall results in the solution being forced up the solution delivery straw. This increased pressure also forces air into the solution delivery straw via the air delivery cross tube located above the level of the foamable solution. The air/solution mixture is then allowed to expand downstream of the air delivery cross tube prior to be forced through a flow restricter, which further homogenizes the air/solution mixture.

Typically the solutions used in dispensing devices are high viscosity, which require higher pressure to force the solution up the solution delivery straw. The increased pressure needed to deliver the solution tends to deliver too much air into the system, which can cause in an improper ratio of solution to air, and ultimately a poorly foamed

solution. Higher viscosity solutions also do not expand and mix as readily when being forced around and through the flow restricters in the dispensing devices. For example, the solution described in United States patent number 5,439,681, which has a viscosity in the range of 490 to 500 centipoise at 24° C, is difficult to deliver through foaming dispenser devices that include flow restricters.

A low viscosity, highly foamable solution is therefore needed to provide the desirable foam output characteristics while maintaining other desirable characteristics. Accordingly, it would be desirable to provide an antimicrobial formulation having a low viscosity, which is highly foamable when used in a foam dispensing device. Additionally, it would be advantageous if the foam produced from the solution is homogenous, consisting of small, homogenous bubbles, having consistency that is neither too wet nor too dry. It would also be desirable it the foam could be smoothly delivered at a consistent volume through the delivery device.

SUMMARY OF THE INVENTION

The present invention is an aqueous foamable antimicrobial formulation comprising an antimicrobial agent, surfactants and emollients. The formulation may be effectively used as a surgical scrub without irritation or dryness to skin.

The aqueous foamable, antimicrobial cleansing formulation of the present invention comprises about 1% to about 4% of an antimicrobial agent having a phenol moeity, about 18% to about 35% of a surfactant selected from the group consisting of nonionic

surfactants, anionic surfactants, amphoteric surfactants, and mixtures thereof; and about 1% to about 5% of an emollient. Preferably, formulation has a viscosity less than 300 centipoise at 24° C, and the viscosity is more preferably less than 200 centipoise at 24° C. In a most preferred embodiment, the formulation has a viscosity less than 100 centipoise at 24° C, typically in the range of about 5 centipoise to about 30 centipoise at 24° C.

In a preferred embodiment, the antimicrobial agent used in the formulation includes triclosan or para-chlorometa-xylenol. Preferably, the surfactant used in the formulation includes an ammonium salt of sulfated nonylphenoxypolyethyloxyethanol, block copolymers of polyoxyethylene and polyoxypropylene, ammonium fatty sulfosuccinates, acyl isethionates and combinations thereof. In a preferred formulation the emollient is selected from lanolin, lanolin derivatives and aloe vera gel, and the formulation includes a glycol such as propylene glycol.

In a most preferred embodiment of the present invention, the formulation comprises about 0.5% to about 4% para-chlorometa-xylenol or triclosan; about 5-20% ammonium cocoyl isethionate; about 1% to about 7% block copolymers of polyoxypropylene and polyoxyethylene; about 3% to about 12% nonylphenoxypolyethylenoxy propanol; and about 2% to about 10% ammonium lauryl sulfosuccinate. The percentages are all in weight percent.

The present invention provides an aqueous antimicrobial formulation that has lower viscosity than prior art antimicrobial formulations. The lower viscosity formulation of the present

invention permits antimicrobial dispensing devices such as the device described in United States patent application serial number 09/512,402 to dispense a foam having small, homogenous bubbles at a consistent delivery volume. Advantageously, the solution provides consistent foam delivery when dispensed from such a dispensing device. The foam produced by the dispensing device has acceptable foam density and is delivered smoothly from the dispensing device. These and other advantages will become apparent from the following detailed description.

DETAILED DESCRIPTION

The present invention relates to aqueous foamable, antimicrobial formulations. One important feature of the formulations of the present invention is the formulations possess a viscosity less than about 300 centipoise at 24° C, preferably less than about 200 centipoise at 24° C, and most preferably less than about 100 centipoise at 24° C. It will be appreciated that the measured viscosity of the formulation will increase as the temperature of the formulation is lowered. The low viscosity solution of the present invention is particularly useful in foam generating dispensing devices, such as the type disclosed in copending United States patent application serial number 09/512,402.

The aqueous, antimicrobial formulation of the present invention generally comprises about 0.5% to about 4% by weight of an antimicrobial agent having a phenol moeity, about 18% to about 35% by weight of a surfactant selected from the group consisting of

nonionic surfactants, anionic surfactants, amphoteric surfactants, and mixtures thereof, and about 1% to about 5% by weight of an emollient. Each component is described further below.

An antimicrobial agent is a compound or substance that kills microorganisms or prevents or inhibits their growth and reproduction. The antimicrobial agent present in the antimicrobial composition is selected to combat the microorganism(s) of concern to the degree desired. The antimicrobial agent is selected so as not to upset desirable physical and chemical properties of human skin. A properly selected antimicrobial agent maintains stability under use and storage conditions (pH, temperature, light, etc.), for a required length of time. A desirable property of the antimicrobial agent is that it is safe and nontoxic in handling, formulation and use, is environmentally acceptable and cost effective.

The antimicrobial agent present in the antimicrobial composition must be capable of being solubilized in the composition without forming an association complex with other components of the composition. The formation of an association complex will prevent the antimicrobial composition from providing maximum antimicrobial efficacy.

Classes of antimicrobial agents include, but are not limited to, phenolics, halogen compounds, quarternary ammonium compounds, metal derivatives, amines, alkanolamines and nitro derivatives, anilides, organosulfur and sulfur-nitrogen compounds.

Preferably, the antimicrobial agent is a phenol derivative. The phenol derivative antimicrobial agent may be selected from triclosan (2,4,4'-trichloro-2'-hydroxy diphenyl ether), triclocarban

(3,4,4'-trichlorocarbanilide, phenoxyethanol, o-phenylphenol and o-phenylphenate. The preferred active antimicrobial agents in the antimicrobial formulation are parachlorometaxylenol (PCMX) and triclosan. Preferably, the PCMX or triclosan is present in the antimicrobial formulation in an amount from about 0.5% to about 4.0%, and preferably at about 3% by weight.

According to the present invention, at least one surfactant is present. A surfactant's classification as anionic, cationic, nonionic or amphoteric, depends on the charge of the surface-active moiety, usually the larger part of the molecule. An anionic surfactant carries a negative charge, a cationic surfactant carries a positive charge, a nonionic surfactant has no charge and an amphoteric surfactant has positive and negative charges in the molecule.

A specific selection of surfactants is required for the antimicrobial composition so that the antimicrobial agent is solubilized and an association complex is not formed between the antimicrobial agent and the surfactants. In particular, it is believed that cationic surfactants will associate to complex an antimicrobial agent such as PCMX and therefore adversely effect the antimicrobial efficacy of the antimicrobial composition. However, the invention should not be limited to any particular theory of operation.

It is believed that a combination of specific nonionic, amphoteric and anionic surfactants in the antimicrobial composition will completely solubilize the antimicrobial agent such as PCMX. The specific combination of nonionic and anionic surfactants will

also not form an association complex with the antimicrobial agent such as PCMX.

A nonionic surfactant for the antimicrobial composition includes, but is not limited to, members of the class of block polymers that may be generically classified as poly(oxypropylene)poly-(oxyethylene) condensates whose various grades fall into a molecular weight range between 1000 to over 15,000, alkylphenol ethoxylates and primary alcohol ethoxylates.

A series of closely related suitable block polymers for the antimicrobial composition includes, but is not limited to PLURONIC* polyols (trademark of BASF, Wyandotte Corp., Wyandotte, Michigan). PLURONIC polyol is a polyglycol (polyoxypropylene-polyoxyethylene block copolymer; CAS registry no.: 9003-11-6). Particular PLURONIC polyols that are useful include, but are not limited to: L31, L35, F38, L43, L42, L62, L63, L64, P65, F68, L72, P75, F77, P84, P85, F87 and F88.

A desirable PLURONIC polyol in the antimicrobial composition is L64. PLURONIC polyol L64 limits the formation of an association complex between the surfactants and the antimicrobial agent in the composition. The approximate molecular weight of PLURONIC polyol L64 is 2900. Preferably, PLURONIC polyol L64 is present in the formulation in amount from about 1% to about 6% by weight, preferably about 2.0% by weight.

In embodiments in which PCMX is the preferred antimicrobial agent, it is believed that an effective amount of nonionic surfactant in the antimicrobial composition is important because the nonionic surfactant is capable of stabilizing and

solubilizing PCMX in solution so as to enhance and maximize the antimicrobial activity of the antimicrobial composition. If the appropriate effective amount of nonionic surfactant is not used, the antimicrobial properties of PCMX may be weakened.

A suitable anionic surfactant for the antimicrobial composition includes but is not limited to sulfated alkyl phenol ethoxylates and alkyl-aryl sulfonates. It is believed that only specific suitable anionic surfactants may be used with specific nonionic surfactants so as to enhance and maximize the antimicrobial activity of the antimicrobial agent, such as PCMX. The anionic surfactants may also be an aliphatic sulfonate, such as a primary alkane (C_8-C_{22}) sulfonate, a primary alkane (C_8-C_{22}) disulfonate, a C_8-C_{22} alkene sulfonate, C_8-C_{22} hydroxyalkane sulfonate or alkyl glyceryl ether sulfonate or an aromatic sulfonate such as alkyl benzene sulfonate.

A suitable anionic surfactant for the antimicrobial composition is GAFAC* LO-529 (trademark of GAF, Wayne, NJ) sold by GAF which is a polyoxyethylene nonylphenol ether phosphate sodium salt. Another suitable anionic surfactant for the antimicrobial composition is WITCONATE* P-1059 (trademark of WITCO) which is an alkyl-aryl sulfonate, isopropylamine salt.

A preferred group of anionic surfactants is the C_8-C_{18} acyl isethionates, preferably present in an amount from about 7% percent by weight to about 15% by weight, more preferably about 10% by weight. A preferred acyl isethionate is JORDAPON ACI-30G, (trademark of BASF, Ludwigshafen, Germany.

Another preferred anionic surfactant for the antimicrobial composition is an ethyl alcohol, ALIPAL* CO-436 (trademark of GAF, Wayne, NJ) sold by GAF, which is an ammonium salt of sulfated nonylphenoxypoly(ethyleneoxy)ethanol (poly(oxy-1,2-ethandyl. Preferably, the ethyl alcohol anionic surfactant is present in the antimicrobial composition in an amount from about 2.0% to about 12.0% by weight and more preferably at about 6.0% by weight. The anionic surfactant should preferably be used in the antimicrobial composition in an amount sufficient to maintain detergent action and so as not to adversely effect the active antimicrobial properties of the antimicrobial composition. In particular, it is not desirable for the anionic surfactant to complex with the antimicrobial agent. Preferably, a combination of anionic surfactants is used, in an amount from about 7% by weight to about 22% by weight, more preferably about 16% by weight.

Amphoteric surfactants can enhance the foaming action of the formulation. A desirable foam builder for the antimicrobial composition includes, but is not limited to ammonium fatty sulfo succinate, alkanolamides such as cocodieth anolamide and amine oxides such as cetyldimethyl amino oxide. In the preferred embodiment, the surfactants are sulfosuccinates and their derivatives. The preferred surfactants are esters of sulpho saturated and unsaturated aliphatic dicarboxylic acids such as mono and disulphosuccinic, sulphochlorosuccinic, sulphobromosuccinic, sulphoadipic, sulphopyrotartaric, sulphoglutaric, sulphosuberic, sulphosebacic, sulphobutylsuccinic, sulphobenzylsuccinic, sulphomaleic, sulphofumaric, sulphodimethylsuccinic, sulphomethylglutaric, sulphopimelinic, sulphopropylsuccinic, sulpho-

octylglutaric, sulphobenzylmalonic, and other sulphonated dicarboxylic acids of the aliphatic series.

Currently, the most preferred commercially available amphoteric surfactant is an ammonium lauryl sulfosuccinate, MONAMATE* LNT-40 (a trademark of MONA Industries, Paterson, NJ) sold by MONA. Preferably, the amphoteric surfactant is present in the antimicrobial formulation in an amount from about 2.0% to about 12.0% and most preferred at about 5.0%.

The formulation may further include non-aqueous solvents, preferably present in an amount from about 1% to about 8% by weight, more preferably present in an amount of about 4% by weight. Examples of suitable non-aqueous solvents include glycols such as ethylene glycol, propylene glycol, butylene glycol, triethylene glycol, hexylene glycol, polyethylene glycols, ethoxydiglycol, and dipropyleneglycol, alcohols such as ethanol, n-propanol, and isopropanol, ethyl acetate, acetone, triacetin, and combinations thereof. A preferred non-aqueous solvent is propylene glycol.

Other optional ingredients in the formulation include emollients. Emollients in general may include oils, fatty solids or waxes. Hydrocarbons function essentially as emollients by virtue of their ability to lubricate and/or hold water at the skin surface due to their relative occlusivity. Mineral oil is such a fluid. Some emollients are hydrophilic (glycerin, propylene glycol) and are water soluble lubricants and humectants. Since emollients may be fatty

chemicals, oily or waxy in nature, they can impart barrier properties to formulations and are then referred to as moisturizers.

Moisturizers are substances which provide external lubricant behavior, such as to soften and sooth the skin because they encourage skin water retention. The function of the moisturizer and/or emollient in the antimicrobial composition is to replace the natural skin oils which are lost or at least, partially removed by the cleansing action of the surfactants in the antimicrobial composition. Therefore chapping of the skin may be prevented. In addition, they also function to dissolve and maintain the oil-soluble antiseptics in the emulsion.

Suitable moisturizes and/or emollients in the antimicrobial composition include, but are not limited to fatty acids, triglycerides, lanolin, derivatives of lanolin such as the ethoxylated, acetylated alcohol and surface active alcohol derivatives of lanolin, propylene glycol, polypropylene glycol, polyethylene glycol, lanolin and lanolin derivatives, mineral oils, fatty alcohols and glycerine.

A preferable moisturizer and/or emollient for the antimicrobial composition is an ethoxylated (75 moles) lanolin, SOLULAN*75 (trademark of Amerchol Corporation, Edison, NJ) sold by Amerchol Corporation. Another preferred moisturizer and/or emollient for the antimicrobial composition is an aloe vera or an ester comprising isopropyl palmitate and lanolin oil, ISOPROPYLAN* 50 (trademark of Amerchol Corporation, Edison, NJ) sold by Amerchol Corporation. Another preferred moisturizer and/or emollient for the antimicrobial composition is a polyethyl glycol lanolin derivative, PEG*75 lanolin (trademark of Amerchol

Corporation, Edison, N.J.) sold by Amerchol Corporation. Another preferred emollient is aloe vera gel.

Preferably, a combination of moisturizers and/or emollients is present in the antimicrobial formulation in an amount from about 1.0% to about 5.0% by weight and most preferred at about 2.6%.

The antimicrobial formulation may further include fragrance and colorants in amounts of less than about 2.0% by weight.

The balance of the antimicrobial composition is preferably water. The water may be present in the antimicrobial composition in an amount from about 60.0% to about 85.0%.

Other ingredients which are conventional or desirable in various cosmetic formulations may also be added to the antimicrobial composition as long as they do not adversely affect the overall properties of the antimicrobial composition.

If desired, the antimicrobial composition of the invention may include a perfume to provide a pleasing scent or a dye to provide a characteristic color.

A preferred formulation of the present invention comprises:

a. about 0.5% to about 4% by weight of para-chlorometa-xylenol or triclosan;

b. about 5 to about 20% by weight of ammonium cocoyl isethionate;

c. about 1% to about 7% by weight of block copolymers of polyoxypropylene and polyoxyethylene;

d. about 3% to about 12% by weight of nonylphenoxypolyethylenoxy propanol; and

about 2% to about 10% by weight of ammonium lauryl sulfosuccinate.

The antimicrobial compositions of the present invention may be found to be highly effective against common microorganisms such as Staphylococcus aureus, Pseudomonas aeruginosa, Candida albicans and Escherichia coli, among others as well as. It is recognized, however, that the effectiveness of the antimicrobial composition depends upon the particular combination of materials, the concentration of ingredients used and the nature of the particular microorganism.

The present invention is set forth in greater detail in the examples which follow. The examples are for illustration purposes only and are not intended to limit the scope of the claims in any way. Generally, the ingredients are identified by their chemical name, CFTA name, or by their trade names. All percentages are in weight percent, and the balance of each example is comprised of water.

EXAMPLES

FORMULATION OF ANTIMICROBIAL COMPOSITIONS

TABLE I

	PCMX					Triclosan	
Ingredient	Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7
Polyoxypropylene Polyoxyethylene Block Copolymer	2.82	2.17	1.90	1.90	1.80	2.82	2.82
ALIPAL CO-436	7.51	5.78	5.20	5.20	4.90	7.51	7.51
Propylene Glycol	5.64	4.34	3.90	3.90	3.70	5.64	5.64
Ammonium Lauryl Sulfosuccinate	7.51	5.78	5.20	5.20	4.90	7.51	7.51
PCMX	3.10	3.10	3.10	3.10	3.10	--	--
Triclosan	--	--	--	--	--	1.10	3.10
Lanolin	3.76	2.89	2.60	2.60	2.40	3.76	3.76
Ammonium Cocoyl Isethionate	11.56	8.89	8.00	13.00	12.60	11.56	11.56
Purified Water	57.63	66.49	69.56	64.56	66.06	59.68	57.68
Aloe Vera Gel	0.12	0.10	0.10	0.10	0.10	0.12	0.12
Fragrance	0.29	0.22	0.20	0.20	0.20	0.30	0.30
0.1% Green #3	0.06	0.19	0.19	0.19	0.19	--	--
0.5% Yellow #10	--	0.05	0.05	0.05	0.05	--	--

The general procedure for combining the ingredients utilized conventional techniques. The lanolin derivative was preheated in a heated tank overnight until the material was melted and in a liquid state. The polyoxypropylene polyoxyethylene block copolymer, ALIPAL CO-436, propylene glycol and ammonium lauryl sulfosuccinate were mixed in a

mixing tank. PCMX (for Examples 1 to 5) or Triclosan (for Examples 6-7) was added next until dissolved. The lanolin derivative was added from the heated tank, and then the ammonium cocoyl isethionate was added. Next, purified water was added, and finally, the colorants, aloe vera gel and fragrance were added to the formulation. Samples were measured for pH, and the pH was adjusted to between 7-8 by adding sodium hydroxide or hydrochloric acid.

Antimicrobial Activity

Example 5 (designated as A in Table II) and Example 7 (designated as B in Table II were tested and compared with the commercially available Ultradex® product, which contains 3% PCMX and is described in United States patent number 4,632,772 issued to Garabedian et. al, to determine their antimicrobial efficacy.

Full strength formulations of A, B and C were diluted with water at a ratio of 1:10 and 1:100. The full strength solutions and the diluted samples were each challenged with 0.1 m. of innoculum containing the number of colony forming units (CFU) of the organisms listed in Table II. The results reported in Table II show the kill time in minutes. "Positive" means colonies were observed after exposure and neutralization (i.e. total kill not achieved). The kill time of 1 minute or 5 minutes means that total kill was achieved after the respective exposure time.

Table II

		BD 3% PCMX Foam	BD 3% Foaming Triclosan	Comparative Example
Organism	**Dilutions**	**A**	**B**	**C**
1. Staphylococcus aureus	Full	1 minute	1 minute	1 minute
1.6 x 10^7 CFU/ml	1:10	1 minute	1 minute	positive
	1:100	no test	no test	positive
2. Pseudomonas aeruginosa	Full	1 minute	positive	1 minute
5.7 x 10^7 CFU/ml	1:10	1 minute	positive	positive
	1:100	no test	no test	positive
3. Candida albicans	Full	positive	positive	1 minute
2.5 x 10^6 CFU/ml	1:10	positive	positive	1minute
	1:100	no test	no test	positive
4. Escherichia coli	Full	1 minute	1 minute	1 minute
8.6 x 10^7 CFU/ml	1:10	1 minute	positive	positive
	1:100	no test	no test	positive

Since *Staphylococcus aureus* is the most commonly found organisms on skin and often difficult to kill completely, the formulations and B of the present invention are more effective than the formulation C disclosed in United States patent number 4,632,772. The present invention may be embodied in other specific forms and is not limited to any specific embodiments described in detail which are merely exemplary. Various other modifications will be apparent to and readily made by those skilled in the art without departing from the scope and spirit of the invention. The scope of the invention will be measured by the appended claims and their equivalents.

WHAT IS CLAIMED IS:

1. An aqueous foamable, antimicrobial liquid cleansing formulation comprising:

about 0.5% to about 4% by weight of an antimicrobial agent having a phenol moeity,

about 18% to about 35% by weight of a surfactant selected from the group consisting of nonionic surfactants, anionic surfactants, amphoteric surfactants, and mixtures thereof; and

about 1% to about 5% by weight of an emollient.

2. The formulation of claim 1, wherein the formulation has a viscosity less than 300 centipoise at 24° C.

3. The formulation of claim 1, wherein the formulation has a viscosity less than less than 200 centipoise at 24° C.

4. The formulation of claim 1, wherein the formulation has a viscosity less than 100 centipoise at 24° C.

5. The formulation of claim 4, wherein the antimicrobial agent includes triclosan or para-chlorometa-xylenol.

6. The formulation of claim 5, wherein the surfactant includes an ammonium salt of sulfated nonylphenoxypolyethyloxyethanol, block copolymers of

polyoxyethylene and polyoxypropylene, ammonium fatty sulfosuccinates, acyl isethionates and combinations thereof.

7. The formulation of claim 6, wherein the emollient is selected from lanolin, lanolin derivatives and aloe vera gel.

8. The formulation of claim 7, wherein further comprising a glycol.

9. A foamable, antimicrobial liquid cleansing formulation comprising:

an antimicrobial agent selected from the group consisting of triclosan and para-chlorometa-xylenol;

an ammonium salt of sulfated nonylphenoxypolyethylenoxy ethanol;

ammonium lauryl sulfosuccinate; and

ammonium cocoyl isethionate.

10. The formulation of claim 9, wherein the formulation has a viscosity of less than 200 centipoise at 24° C.

11. The formulation of claim 9, wherein the formulation has a viscosity less than 100 centipoise at 24° C.

12. The formulation of claim 9, further comprising lanolin and propylene glycol.

13. A foamable, antimicrobial liquid cleansing formulation comprising:

a. about 0.5% to about 4% by weight of para-chlorometa-xylenol or triclosan;

e. about 5 to about 20% by weight of ammonium cocoyl isethionate;

f. about 1% to about 7% by weight of block copolymers of polyoxypropylene and polyoxyethylene;

g. about 3% to about 12% by weight of nonylphenoxypolyethylenoxy propanol; and

h. about 2% to about 10% by weight of ammonium lauryl sulfosuccinate.

14. The formulation of claim 13, further comprising one or more of the group including glycols, triglycerides, and alcohols.

INTERNATIONAL SEARCH REPORT

ernational Application No
PCT/US 01/09267

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C11D3/48 C11D3/20 C11D3/24 C11D1/02 C11D1/66
C11D1/88 C11D1/12 C11D1/29 C11D1/722 C11D1/83
C11D3/382 C11D3/384 A01N31/16 A01N31/08 A61K31/055

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C11D A01N A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
WPI Data, EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 439 681 A (KHAN MOHAMMAD A ET AL) 8 August 1995 (1995-08-08) cited in the application	1,5-9
A	example II	12-14
X	EP 0 689 767 A (BECTON DICKINSON CO) 3 January 1996 (1996-01-03)	1,5,7,8
A	page 3, line 2 - line 16; claim 9; table 1	9-14
X	EP 0 086 878 A (DEXIDE INC) 31 August 1983 (1983-08-31)	1,5,7
A	page 5, line 1 - line 3; table I	9,12,13
A	WO 91 17237 A (PROCTER & GAMBLE) 14 November 1991 (1991-11-14) page 3, paragraph 1; claims 1,10; examples VI-VIII	1-5, 9-11,13

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

'A' document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search	Date of mailing of the international search report
17 September 2001	25/09/2001
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Saunders, T

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INTERNATIONAL SEARCH REPORT

ernational Application No
PCT/US 01/09267

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61K31/085 //C11D1/72

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 96 06153 A (CIBA GEIGY AG (CH)) 29 February 1996 (1996-02-29) abstract page 11, paragraph 3; example 1	1,8,9, 12-14
A	EP 0 882 446 A (GOJO IND INC) 9 December 1998 (1998-12-09) page 2, line 19 - line 25 page 6, line 1 - line 7; tables II,V	1,5,7,9, 12-14

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
17 September 2001	

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Saunders, T

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